EXPECTED CONTRIBUTION OF MODELLING IN FUSARIUM AND DON RISK MANAGEMENT AT DIFFERENT SPATIAL AND TEMPORAL SCALES IN A CLIMATE CHANGE CONTEXT

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Introduction

Fusarium graminearum, pathogen causing Fusarium head blight in wheat, is known to be strongly impacted by climate conditions and lead to variable consequences in terms of kernel damages and sanitary quality from one year to another. The issue around climate change raises the question of the evolution of this pathosystem in the future and its impact on the content of deoxynivalenol (DON), mycotoxin produced by this pathogen and regulated by the UE. The present study examines the use of predictive models to assess the risk of *F. graminearum* and DON production in the future.

Materials and Methods

To conduct the study, climate series used are from the ANR Scampei (Déqué, 2011). Two climate projections to changes in atmospheric CO2 concentrations were studied, a median scenario (A1B) with a projection of a CO2 level of 650 ppm in 2100; and a pessimistic scenario (A2) with a CO2 concentration of 700 ppm by 2100. Three periods were identified to achieve the projections: the past (REF) provides climate data 1962 to 1990, regarded as the reference years prior to the impact of climate change, the near future (NF) relates to climate data from the 2022-2050 and the far future (FF) involves climate data from 2072 to 2100. Different variables from different models, more or less complex, were studied. A first projection has been made on the flowering date (wheat sensitivity period to infection by the pathogen) to assess the impact of climate change on the flowering period. For this, the model used is a phenological model of occurrence of wheat stages described in Gouache et al. (2012). A second projection was performed on the amount of primary inoculum around flowering by using a mechanistic model described in Corre et al., 2015. The last projection was made on the DON content in wheat grain by using a statistical model (Gourdain et al. 2015). All the simulation was performed using the French variety Cellule sown the 20th of October with maize as previous crop and no plow. The temporal variability was studied with boxplot, the spatial variability with map.

Results and Discussion

The projections on the flowering date show an advance of 10 to 15 days (Fig.1a) consistent with the literature (Lawlor and Mitchell, 2000). The use of very different models developed and validated with different data lead to the same conclusions in a context of climate change: reduction of the amount of inoculum (Fig.1b) and the DON content in wheat grain (Fig.1c) and mainly for the pessimistic scenario.

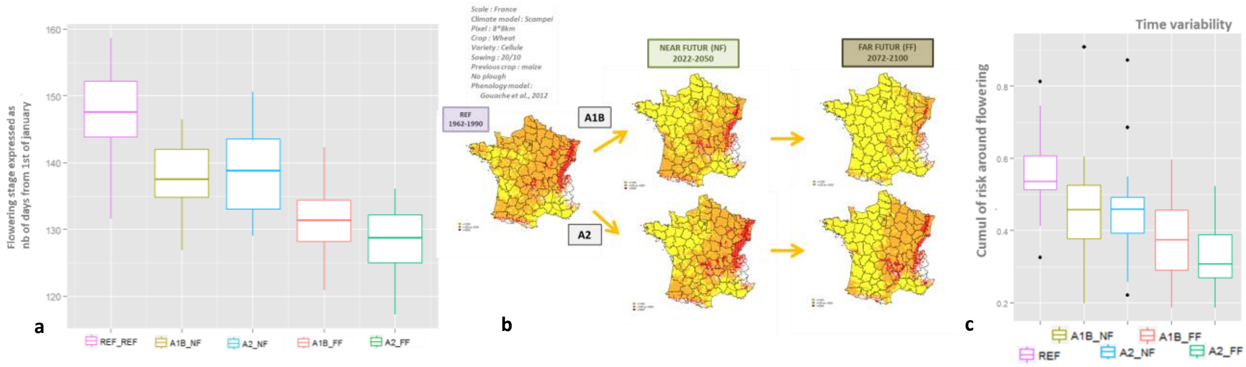

Figure 1 : results of the projection (a) boxplot of the flowering date expressed as number of days from 1/1; (b) map of predicted median DON content in 3 classes (yellow <=1250; orange >1250 et <3000 ; red >=3000 µg/kg); (c) boxplot of the predicted amount of inoculum for the different scenario

This decrease is partly due to reduced rainfall events during the spring reducing pathogen inoculum potential. Thus, it has been shown that models both inoculum production and DON content that were particularly sensitive to rain events which are very variables from one climate model to another. To obtain more robust trends and to reduce uncertainties such as rain events, varieties, strains and agronomic practices evolution, several climate models and agronomic models should be used.

Conclusions

The results of simulations from climate scenarios proposed within the framework of the ANR Scampei show that the risk of development of *F. graminearum* and the production of DON should not increase in the future in France in spite of a certain spatio-temporal variability. Nevertheless, these results are to be qualified in light of the many sources of uncertainties but it brings elements of reflection needed to guide research and to drive the broad policy makers.

More Details

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